

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 10/604,011

Conf. No.: 1010

Applicant: Greco

TC/AU: 1756

Filed: 06/20/2003

Examiner: Chacko Davis, Daborah

Customer No.: 23550

Docket: FIS920030144US1
(IBMF-0019)

Title: INTEGRATED CIRCUIT FUSE AND
METHOD OF OPENING

Mail Stop Appeal Brief – Patents
Commissioner for Patents
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REPLY BRIEF OF APPELLANT

This is a reply brief, which is being filed in response to the Examiner's Answer dated 11 December 2006 to address new evidence made of record and new clarifications to the Examiner's position presented in the Examiner's Answer.

REMARKS

In the Examiner's Answer, the Office's arguments diverge slightly from previous arguments. Appellant hereby responds to those differences herein.

A. Response to Arguments Part A) of Examiner's Answer

The Office apparently is asserting that the liner in Daubenspeck, which may make up part of the fuse, is a non-last metal layer. Appellant submits that this interpretation is contradictory to all standards used in semiconductor fabrication, and incongruous to other statements made in Daubenspeck. As understood in the art, liners are used to prevent diffusion of metal into a dielectric and accompany practically all metal in semiconductor devices. However, they are never considered as separate metal layers as that term is understood in the art. Metal layers within a semiconductor device are considered to include a dielectric layer including metal segments and liners for the metal segments as one entity (and oftentimes, vias for the metal and liners therefor). Even using the broadest possible interpretation, one cannot ignore longstanding and conventional understanding within a technology. Appellant's use of the conventional understanding is clear from the specification, including the drawings, in that Appellant does not differentiate a liner and a metal therein as separate metal layers.

More significantly, however, is that Daubenspeck does not contradict that standard in that Daubenspeck clearly refers to the layer below where the fuse is located as the last metal minus one (LM-1) layer. See, e.g., col. 8, line 49, and especially, col. 8, lines 53-56. If any part of the fuse in Daubenspeck is considered other than in the last metal layer, these statements make no sense.

The Office cites col. 3, lines 57-67 and col. 4, lines 1-5 and FIG. 1E to support the argument that the fuse element is in a non-last metal layer. Examiner's Answer at page 5. But,

this citation clearly states that the process is applied “to damascene a last metal (LM) wiring level and fuses.” Col. 3, lines 61-62. The Office may be confused by the statement, at col. 4, lines 3-5, that “the fuse is comprised of at least one of a segment of liner and a segment of the copper LM line isolated on at least one side by a “liner only” structure.” As understood in the art, however, the liner is part of the last metal layer. The Office’s citation to col. 3, lines 46-60 and the fact that the metal structure may include “a first portion including a lower layer and an upper layer” adds nothing to the discussion because both lower and upper layers are in the last metal layer as understood by those of ordinary skill in the art.

The Office cites col. 8, lines 41-45 and FIG. 2 to argue disclosure of “forming the fuse line in a non-last metal layer i.e., in a LM-1 layer.” Examiner’s Answer at page 6. However, the actual language used by Daubenspeck is not that clear. The lines cited state: “a fuse line can be formed including a resist layer, an oxide layer and a last metal minus one (LM-1) layer.” Clearly, a fuse line cannot “include” a resist layer or an oxide layer, which are non-conducting. Further, the fuse line including the LM-1 layer does not make sense, especially since Daubenspeck goes on to state in the same paragraph that the oxide layer into which the fuse line is formed is formed “over the previously deposited LM-1 layer.” Col. 8, line 49. Daubenspeck states in the next paragraph that ILD oxide layer 106 into which the fuse is formed “can overlay last metal minus 1 (LM-1) layer segments 108a and 108b.” Col. 8, lines 55-56.

B. Response to Arguments Part B) of Examiner’s Answer

The Office refers to wire segments 108A and 108B as “of a fuse element.” Examiner’s Answer at page 6. However, those segments are never considered as part of a fuse element by Daubenspeck. Only element 114 is referred to as the fuse element. Appellant submits that the

logic of what is part of a fuse element should only be extended so far, e.g., to the part that actually is removed and the immediately adjacent parts. As Daubenspeck does not stretch the logic to the point of including any wire downline from the fuse as being part of the fuse element, the Office should avoid such a strained interpretation of what the fuse element entails.

C. Response to Arguments Part C) of Examiner's Answer

The Office is misinterpreting the Appellant's argument. It's not that Daubenspeck fails to disclose the opened fuse line includes a metal liner, it's that Daubenspeck fails to disclose that the liner remains intact.

D. Response to Arguments Part D) of Examiner's Answer

The Office's citation to col. 3, lines 60-67 and col. 4, lines 1-5 and FIG. 1G and the statements regarding an etchant's impact on the liner do not seem relevant. Examiner's Answer at page 6. First, any etching performed in Daubenspeck is unrelated to blowing of the fuse, which is performed by laser deletion. Col. 10, lines 64-65 (emphasis ours) state: "Following laser deletion of fuse line 114c (also removing the liner below segment 114c)..." Second, the liners 114b, 114d remaining after laser deletion of fuse line 114c are clearly in contact with the terminals 114a, 114e in FIG. 1G. Third, the liner, as initially deposited, extends over all of the opening in dielectric 106 because to do otherwise would allow diffusion of the metal into dielectric 106. Finally, the liner under fuse line 114c cannot be left intact in order to blow the fuse. See again, col. 10, lines 64-65 (quoted above).

E. Conclusion

In summary, Appellant maintains that claims 1-5 and 7-30 are allowable because Daubenspeck fails to teach each and every element as set forth in the claims 1-5 and 7-30, and with regards to claim 5, Huggins does not remedy the deficiency in Daubenspeck.

Respectfully submitted,

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Dated: 12 February 2007